Ordering number: EN 5109

Monolithic Linear IC



No. 5109

LA7416,7416M

Playback Amplifier and Record Amplifier for VHS VCRs

Overview

The LA7416 and LA7416M are playback and record amplifier ICs for four-head VHS VCRs. When used in conjunction with the video signal processing ICs of the LA7420/30 series, it is possible to eliminate the need to adjust the Y/C record current.

Functions

- 4-channel playback amplifier.
- 2-channel recording amplifier (AGC built-in).
- REC/PB mode switching head switch circuit.
- Envelope wave detection (for auto-tracking).
- Envelope comparator.

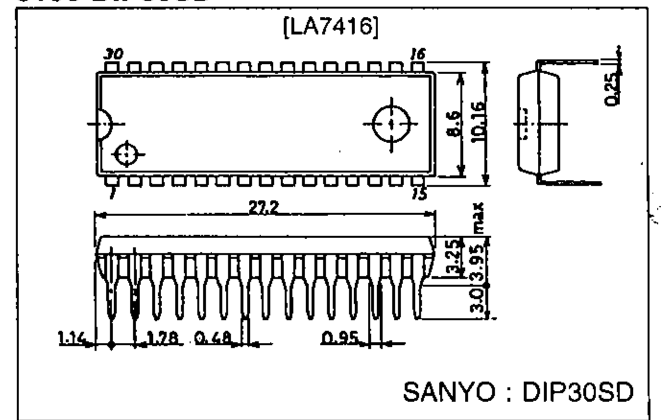
Features

- The record amplifier provides stable record characteristics in constant current drive mode, which is able to withstand load fluctuations. In addition, the built-in AGC eliminates the need to adjust the record current.
- Designed to share printed circuit boards with the LA7411/7411M (for 2-head systems).

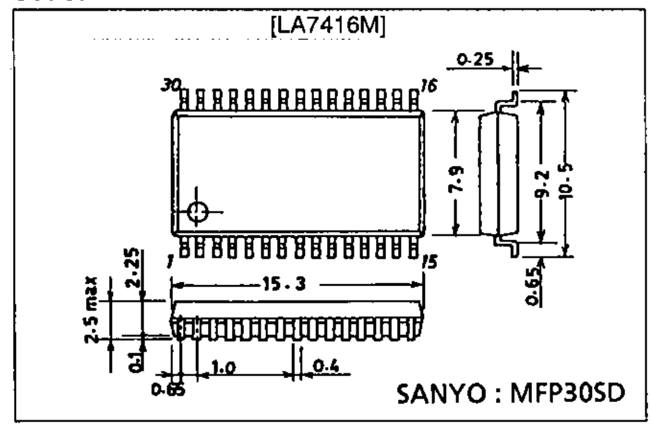
Package Dimensions

unit : mm

3196-DIP30SD



3073A- MFP30SD



Specifications

Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}max		7.0	V
Allowable power dissipation	Pd max	Ta ≦65 °C	650	mW
			*500	mW
Operating temperature	Topr		–10 to +65	°C
Storage temperature	Tstg		–40 to +150	°C

*: LA7416M Pd max value which represents the value when mounted on the board.

Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		5.0	V
Operating voltage range	$V_{CC}op$		4.8 to 5.5	V

Electrical Characteristics at Ta = 25 °C

Parameter			Symbol	Input	Output	Conditions	T2	T4	T5	min	typ	max	Unit
[PB Mode]						T15: 5.0 V T13: Open T7: Open	TRCK	HA	SW30 MUTE				
Current consumption			I_{CCP}			Pin 15 input current	Open	0	0	26	30	34	mA
Voltage gain	SP L	CH1	$G_{VP}1$	T20A	T10A	V_I = 38 mVp-p f = 1 MHz	Open	0	0	54.0	57.0	60.0	dB
	SP H	CH2	$G_{VP}2$	T23A	T10A		Open	0	2.5	54.0	57.0	60.0	dB
	EP L	CH3	$G_{VP}3$	T27A	T10A		Open	5.0	0	56.0	59.0	62.0	dB
	EP H	CH4	$G_{VP}4$	T30A	T10A		Open	5.0	2.5	56.0	59.0	62.0	dB
Voltage gain difference 1			$\Delta G_{VP}1$			$G_{VP}1 - G_{VP}2$				–1	0	+1	dB
Voltage gain difference 2			$\Delta G_{VP}2$			$G_{VP}3 - G_{VP}4$				–1	0	+1	dB
Intermode gain difference			$\Delta G_{VP\ EP\text{-}SP}$			$G_{VP}3 - G_{VP}1$				1.0	2.0	3.0	dB
Equivalent input noise voltage		CH1	$V_{NIN}1$	T20A	T10A	After 1.1 MHz LPF $\frac{V_{OUT}}{G_{VP}1,2,3,4}$	Open	0	0		1.1	1.5	μVrms
		CH2	$V_{NIN}2$	T23A	T10A		Open	0	2.5		1.1	1.5	μVrms
		CH3	$V_{NIN}3$	T27A	T10A		Open	5.0	0		1.1	1.5	μVrms
		CH4	$V_{NIN}4$	T30A	T10A		Open	5.0	2.5		1.1	1.5	μVrms
Frequency characteristics		CH1	$\Delta Vfp1$	T20A	T10A	V_I = 38 mVp-p f = 7 MHz $\frac{V_{OUT}}{G_{VP}1,2,3,4}$ output ratio	Open	0	0	–2.5	+1		dB
		CH2	$\Delta Vfp2$	T23A	T10A		Open	0	2.5	–2.5	+1		dB
		CH3	$\Delta Vfp3$	T27A	T10A		Open	5.0	0	–2.5	+1		dB
		CH4	$\Delta Vfp4$	T30A	T10A		Open	5.0	2.5	–2.5	+1		dB
Secondary harmonic distortion		CH1	$V_{HDP}1$	T20A	T10A	V_I = 38 mVp-p f = 4 MHz $\frac{8\ M\ component}{4\ M\ component}$ output ratio	Open	0	0		–40	–35	dB
		CH2	$V_{HDP}2$	T23A	T10A		Open	0	2.5		–40	–35	dB
		CH3	$V_{HDP}3$	T27A	T10A		Open	5.0	0		–40	–35	dB
		CH4	$V_{HDP}4$	T30A	T10A		Open	5.0	2.5		–40	–35	dB
Maximum output level		CH1	$V_{OMP}1$	T20A	T10A	f = 1 MHz Output level when tertiary distortion of the output is –30 dB	Open	0	0	1.0	1.2		Vp-p
		CH2	$V_{OMP}2$	T23A	T10A		Open	0	2.5	1.0	1.2		Vp-p
		CH3	$V_{OMP}3$	T27A	T10A		Open	5.0	0	1.0	1.2		Vp-p
		CH4	$V_{OMP}4$	T30A	T10A		Open	5.0	2.5	1.0	1.2		Vp-p
Cross-talk SP (Note 1)		CH1	$V_{CR}1$	T23A	T10A	V_I = 38 mVp-p f = 4 MHz $\frac{V_{OUT}}{G_{VP}1,2}$	Open	0	0		–40	–35	dB
				T27A	T10A		Open	0	0		–40	–35	dB
				T30A	T10A		Open	0	0		–40	–35	dB
		CH2	$V_{CR}2$	T20A	T10A		Open	0	2.5		–40	–35	dB
				T27A	T10A		Open	0	2.5		–40	–35	dB
				T30A	T10A		Open	0	2.5		–40	–35	dB
Cross-talk EP (Note 1)		CH3	$V_{CR}3$	T20A	T10A	V_I = 38 mVp-p f = 4 MHz $\frac{V_{OUT}}{G_{VP}3,4}$	Open	5.0	0		–40	–35	dB
				T23A	T10A		Open	5.0	0		–40	–35	dB
				T30A	T10A		Open	5.0	0		–40	–35	dB
		CH4	$V_{CR}4$	T20A	T10A		Open	5.0	2.5		–40	–35	dB
				T23A	T10A		Open	5.0	2.5		–40	–35	dB
				T27A	T10A		Open	5.0	2.5		–40	–35	dB

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Parameter	Symbol	Input	Output	Conditions	T2	T4	T5	min	typ	max	Unit
Output DC offset	$\Delta V_{ODC}1$		T10A	CH1—CH2	Open		0	–100	0	+100	mV
					Open	0	2.5	–100	0	+100	mV
	$\Delta V_{ODC}2$		T10A	CH3—CH4	Open		0	–100	0	+100	mV
					Open	5.0	2.5	–100	0	+100	mV
	$\Delta V_{ODC}3$		T10A	CH1—CH3	Open	0		–100	0	+100	mV
					Open	5.0	0	–100	0	+100	mV
	$\Delta V_{ODC}4$		T10A	CH2—CH4	Open	0		–100	0	+100	mV
					Open	5.0	2.5	–100	0	+100	mV
	$\Delta V_{ODC}5$		T10A	CH1—CH4	Open	0	0	–100	0	+100	mV
					Open	5.0	2.5	–100	0	+100	mV
	$\Delta V_{ODC}6$		T10A	CH2—CH3	Open	0	2.5	–100	0	+100	mV
					Open	5.0	0	–100	0	+100	mV
Envelope wave detection output pin voltage	V_{ENV}		T8	T8 DC voltage with no input	Open	0	0	0	0.8	1.5	V
Envelope wave detection voltage SP1	$V_{ENVSP}1$	T20A	T8	f = 4 MHz, T10A: Adjusted to 175 mVp-p	Open	0	0	2.1	2.6	3.1	V
Envelope wave detection voltage SP2	$V_{ENVSP}2$	T20A	T8	f = 4 MHz, T10A: Adjusted to 450 mVp-p	Open	0	0	4.5	4.8	5.0	V
Envelope wave detection voltage EP1	$V_{ENVEP}1$	T27A	T8	f = 4 MHz, T10A: Adjusted to 125 mVp-p	Open	5.0	0	2.0	2.5	3.0	V
Envelope wave detection voltage EP2	$V_{ENVEP}2$	T27A	T8	f = 4 MHz, T10A: Adjusted to 350 mVp-p	Open	5.0	0	4.5	4.8	5.0	V
Comparator output voltage 1	$V_{COMP}1$	T20A	T3	f = 4 MHz, V_I = 38 mVp-p T3 DC voltage	5.0	0	0		0.4	0.7	V
Comparator output voltage 2	$V_{COMP}2$	T27A	T3	f = 4 MHz, V_I = 38 mVp-p T3 DC voltage	5.0	5.0	0	4.5	4.8		V
ON resistance of SW-Tr which is turned ON in PB mode	$R_{PON}17$		P-17	DC difference measured for 1 mA, 2 mA current inflow					4.0	6.0	Ω
	$R_{PON}18$		P-18						4.0	6.0	Ω
ON resistance of SW-Tr which is turned ON in PB mode	$R_{PON}21$		P-21	DC difference measured for 1 mA, 2 mA current inflow	Open	5.0			4.0	6.0	Ω
	$R_{PON}24$		P-24		Open	5.0			4.0	6.0	Ω
	$R_{PON}26$		P-26		Open	0			4.0	6.0	Ω
	$R_{PON}29$		P-29		Open	0			4.0	6.0	Ω
Trick 1 threshold level	TR1-1		T2	Normal → Trick 1	*			3.2		5.0	V
	TR1-2		T2	Trick 1 → Normal	*			1.2		2.8	V
Trick 2 threshold level	TR2-1		T2	Normal → Trick 2	*			0.0		0.8	V
	TR2-2		T2	Trick 2 → Normal	*			1.2		2.8	V
HAPB threshold level	HAP-1		T4	SP → EP		*		1.8		5.0	V
	HAP-2		T4	EP → SP		*		0.0		1.4	V
SW30 threshold level	SW30-1		T5	Lch → Hch			*	1.2		5.0	V
	SW30-2		T5	Hch → Lch			*	0.0		0.8	V

Note 1: Status where input stage L (8.2 μH) is shorted

Note: Because the T4 (HA) control switching timing is synchronized with T6 (H-Sync), a trigger pulse (0 V to 5 V to 0 V) must be input to T6 before measuring each parameter for the LA7416/M.

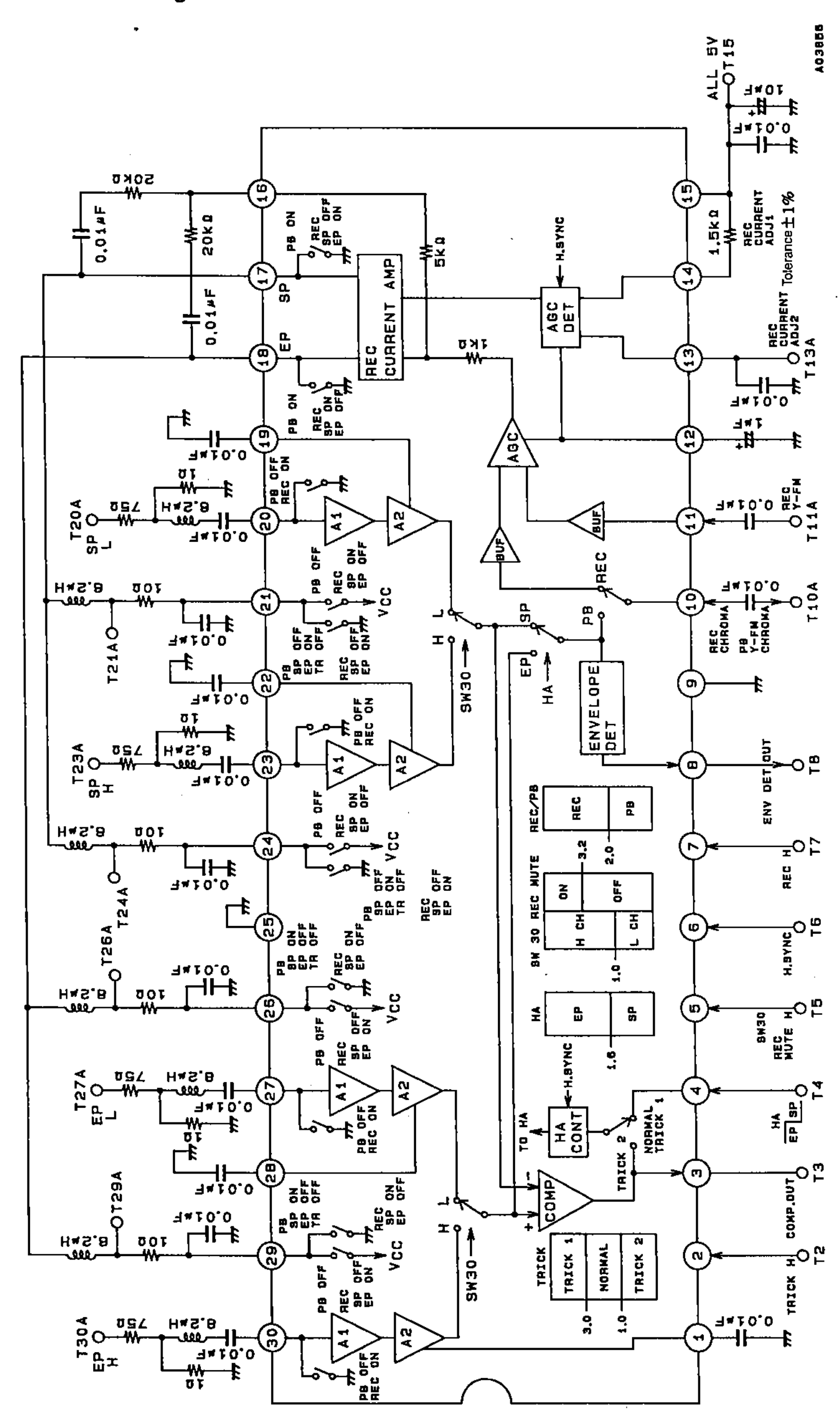
"*" represents output pins.

Electrical Characteristics at Ta = 25 °C

Parameter	Symbol	Input	Output	Conditions	T13	T4	T5	min	typ	max	Unit
[REC Mode]				T15: 5.0 V T2: Open T6: 5.0 V T7: 5.0 V	REC Adj2	HA	SW30 MUTE				
Current consumption	I_{CCP}			Pin 15 current input	Open	0	0	50	55	60	mA
REC AGC Amp output level	V_{RSP}	T11A	T21A	f = 4 MHz	Open	0	0	147	156	165	mVp-p
	V_{REP}	T11A	T26A	V_I = 200 mVp-p	Open	5.0	0	116	123	130	mVp-p
Intermode gain difference	ΔG_{VR}			V_{RSP}/V_{REP}				1.30	2.05	2.80	dB
REC AGC Amp control characteristics 1	ΔV_{AGC}1-SP	T11A	T21A	f = 4 MHz, V_I = 400 mVp-p	Open	0	0		0.5	1.0	dB
	ΔV_{AGC}1-EP	T11A	T26A	Output level/ $V_{RSP, EP}$ ratio	Open	5.0	0		0.5	1.0	dB
REC AGC Amp control characteristics 2	ΔV_{AGC}2-SP	T11A	T21A	f = 4 MHz, V_I = 100 mVp-p	Open	0	0	–1.0	–0.5		dB
	ΔV_{AGC}2-EP	T11A	T26A	Output level/ $V_{RSP, EP}$ ratio	Open	5.0	0	–1.0	–0.5		dB
REC AGC Amp frequency characteristics (Note 2)	ΔV_{FRS}	T11A	T21A	f = 1 M, 7 MHz, V_I = 200 mVp-p	Open	0	0	–4.0	–3.0	–2.0	dB
	ΔV_{FRE}	T11A	T26A	7 MHz/1 MHz, output ratio	Open	5.0	0	–4.0	–3.0	–2.0	dB
REC AGC Amp secondary harmonic level	ΔV_{HDRS}	T11A	T21A	f = 4 MHz, V_I = 200 mVp-p	Open	0	0		–45	–40	dB
	ΔV_{HDRE}	T11A	T26A	8 M component / 4 M component output ratio	Open	5.0	0		–45	–40	dB
REC AGC Amp maximum output level (Note 3)	ΔV_{OMRS}	T11A	T21A	f = 4 MHz, Output level when secondary distortion of the output is –30 dB	Adj.	0	0	20	22		mAp-p
	ΔV_{OMRE}	T11A	T26A		Adj.	5.0	0	20	22		mAp-p
REC AGC Amp mute attenuation	ΔV_{MRS}	T11A	T21A	f = 4 MHz, V_I = 200 mVp-p	Open	0	5.0		–45	–40	dB
	ΔV_{MRE}	T11A	T26A	Output level/ $V_{RSP, EP}$ output ratio	Open	5.0	5.0		–45	–40	dB
REC AGC Amp mixed modulation relative level	ΔV_{CYS}	T10A	T21A	T10A: f = 629 kHz, V_I = 360 mVp-p	Open	0	0		–45	–40	dB
	ΔV_{CYE}	T11A	T26A	T11A: f = 4 MHz, V_I = 200 mVp-p (4 M±629 k)/4 M output ratio	Open	5.0	0		–45	–40	dB
ON resistance of SW-Tr which switches between modes in REC mode	R_{RON}17		P-17	DC difference measured for 1 mA, 2 mA current inflow	Open	5.0			4.0	6.0	Ω
	R_{RON}18		P-18		Open	0			4.0	6.0	Ω
	R_{RON}21		P-21		Open	5.0			4.0	6.0	Ω
	R_{RON}24		P-24		Open	5.0			4.0	6.0	Ω
	R_{RON}26		P-26		Open	0			4.0	6.0	Ω
	R_{RON}29		P-29		Open	0			4.0	6.0	Ω
HA REC threshold level	HAR-1		T4	SP → EP		*		1.8		5.0	V
	HAR-2		T4	EP → SP		*		0.0		1.4	V
REC MUTE threshold level	MUTE-1		T5	MUTE OFF → ON			*	3.4		5.0	V
	MUTE-2		T5	MUTE ON → OFF			*	0.0		3.0	V
REC/PB threshold level	SW REC/ PB			T7: Control voltage				2.2		5.0	V

Note 2: Apply approximately 1.8 V DC to the AGC wave detection filter pin (pin 12) and fix the amplifier gain for measurement.
Note 3: Apply DC voltage to T13 (REC CUR. ADJ2) and adjust the output level.
Note: Use a resistor with a tolerance of ± 1.0% between pins 14 and 15.
"*" represents output pins.

Test Circuit Diagram



Sample Application Circuit

